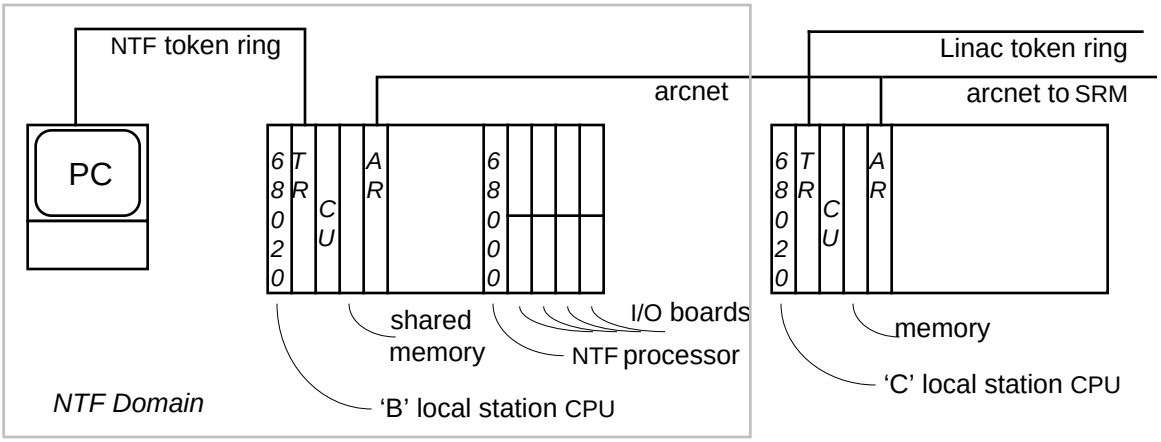
NTF Connection

Linac control system implementation

Dec 20, 1991

NTF architecture

Neutron therapy signals are primarily interfaced via a special 68000 CPU board running a small (4K) program that measures the delivered dose and stops the treatment when the prescribed limit is reached. It also checks for a number of error conditions and stops treatment if these occur. This dedicated program is driven by a PC-based user interface that is connected to a local station whose crate houses the dedicated processor.



The 'B' local station supports the token ring connection to the PC that is the NTF host, providing the user interface for patient treatment. This local station has the same complement of hardware / software as any other, with the addition of a special co-processor to handle the NTF-specific functions. The non-volatile memory board that houses the local station database and software also provides the connection between the two processors in the same VME crate, which is necessary because the I / O boards are accessible only from the MVME-110 68000 board. Every 15 Hz cycle, the 68000 copies about 256 bytes of data readings and diagnostic info into (a small part of) the shared memory. Likewise, settings are sent to the 68000 via a small command message queue in the shared memory. Station 'B's know ledge of the shared memory is limited to the data access table entries that copy from the shared memory data and also the co-proc essor queue table entry that specifies the location and size of the command queue.

The ‘C’ local station provides access to the NTF system from the rest of the control system in a controlled way. It collects data via arcnet from ‘B’ using the SRM data acquisition protocol. It also makes settings as if ‘B’ were an SRM.

Note that there is some effort to isolate the special NTF functions from arbitrary access by the rest of the control system; however, the rest of the control system does need to access some NTF data and even control a few signals. The ‘C’ local station and its arcnet connection to ‘B’ provides for this.

History

The previous version of the architecture used a byte-wide fifo link connection between the special NTF co-processor and station ‘C’. The reason for the new arch itecture using arcnet is to retire the special byte-wide link interface, replacing it with one commonly used with new Linac local stations.

Data acquisition

In order to make station ‘B’ behave to station ‘C’ as if it were an SRM, a local application called SRMD is installed in station ‘B’. It receives the SRM cycle request issued by ‘C’ every 15 Hz cycle. (In fact, it is broadcast to the arcnet network so that both its SRM and ‘B’ receive the same request message.)

By the time ‘C’ receives its (delayed) 15 Hz interrupt signal, the data from the special NTF processor has already been copied into the shared memory. This means that the request message subsequently sent by ‘C’ cannot arrive too early for ‘B’. When ‘B’ is processing its data access table, it calls the SRMD local appli cation, which looks for the request message over arcnet from ‘C’. (SRMD may wait for a short time to be sure ‘C’ has a chance to issue that request message.) The arcnet interrupt code in ‘B’ should expect a cycle data request and pass it through to the message queue that SRMD polls. (This is also done for data acquisition replies, as in ‘C’.)

The local application builds a reply message containing readings of selected ana log channels of station ‘B’, including 8 words of nominal and tol erance values from the co-processor’s prom-based table used for check ing beam transmission ratios. (These latter values do not change, of course, but they are needed for operator reference.) The reply message is queued to the net work and sent to ‘C’, where it is mapped into assigned channel readings in its database. Other nodes on token ring can access this data from ‘C’ to view NTF data.

Settings

For handling settings, a node sends a setting message to ‘C’. For a channel in the NTF system which is permitted to have control, a short setting message is sent via arcnet to ‘B’. The SRMD local application reads this setting message containing a reference to an analog channel number of ‘B’. It merely calls the setting routine to control that “local” channel. If the analog control field of the channel’s analog descriptor entry permits settings, a short setting message is placed into the com mand queue. The co-processor notices it and executes the command. Assurance of success comes from the expected change in the NTF data refreshed every cycle.

Other details

The PC host operates through ‘B’, whereas other nodes’ access to NTF is via ‘C’. This provides an easy way to limit which signals are controllable from outside the NTF domain.

Currently, NTF signals controllable via ‘B’ are the beam on-off pulse ratio, the dose accumulations and dose limits, un-clamp integrator gate, and reset. Signals controllable via ‘C’ are the beam on-off pulse ratio, nominal and tolerance values for the 58° and 32° magnet currents, rise time of the 58° magnet, and reset.

Because ‘B’ behaves as an SRM to ‘C’, there is a status bit that can be monitored to generate an alarm condition if ‘B’ is not responding to the request message. Data acquisition from each SRM includes generation of this pseudo status bit.